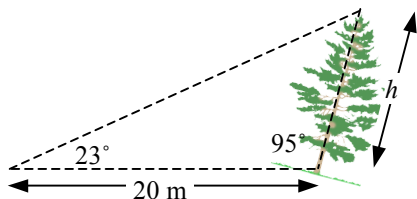


A Finely Crafted O'Brien Unit 3 Opportunity Day

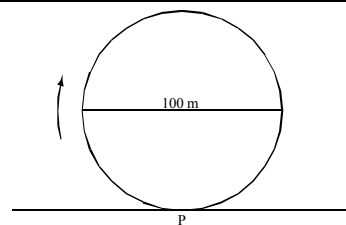
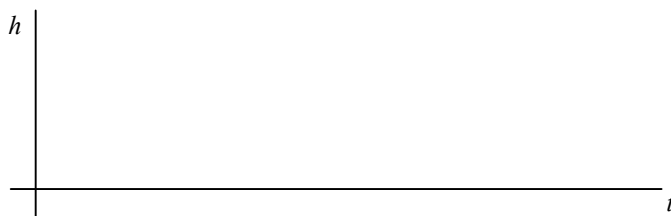
Calculator Section: You may use a calculator. Show all work and circle your answer. Use your time wisely; you will be able to earn additional credit after the timed portion of the test by completing Supercorrections. When you finish, put away your calculator and you can come up to get the non-calculator part- you may continue to work on both sections without your calculator.

1. Because of prevailing winds, a tree grew so that it was leaning 5° from the vertical. At a point 20 meters from the tree, the angle of elevation to the top of the tree is 23° (see figure). Find the height h of the tree to the nearest tenth of a meter.



2. At right is a diagram of a Ferris wheel of diameter 100 meters with a lowest point P on the ground. It makes one complete revolution every 120 seconds.

- a. Sketch a graph of the vertical position function for point P . Place time on the horizontal axis and the vertical position of P on the vertical axis.



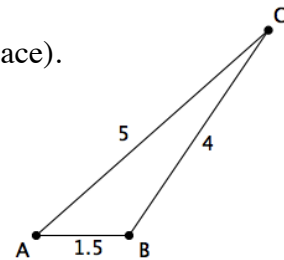
- b. Use this graph to find the equation of the vertical position for point P .
- c. Use your function to find the time when the vertical position of point P is first at 15 meters.

3. The function $f(x) = \sin^2 x$ can be written as $f(x) = a \cos(bx) + c$. Use the graph of f to find a , b , and c .

4. A hiker is 5 miles east and 2 miles south of base camp. What bearing should she take to hike directly back to base camp?

5. Consider the triangle at right.

a. Use the Law of Cosines to find the size of angle A (1 decimal place).



b. Use the Law of Sines to attempt to find the size of angle B (1 decimal place), subtract from 180° to find the value of C, and then explain why your answers are not reasonable.

c. Using your understanding of the Ambiguous Case with the Law of Sines, explain what is happening. You may want to draw on the diagram.

6. Find, if possible, the period and amplitude of each function.

a. $y = -4 \sin \pi x + 9$

Period: _____

Amplitude: _____

b. $y = 2 \tan \left(\frac{x}{4} - \frac{\pi}{3} \right) + 5$

Period: _____

Amplitude: _____

NON-CALCULATOR

Name: _____

7. Given the angle θ (in standard position) whose terminal side passes through the point $(3, -6)$, find $\cos\theta$ and $\cot\theta$.

8. Given that $\sin P = \frac{3}{5}$ and P is in Quadrant II, find

a. $\tan P$

b. $\sec P$

9. What is a radian?

10. Let $p = \sin 20^\circ$. Give your answers to the following in terms of p .

a. $\sin 160^\circ$

b. $\cos 160^\circ$

c. $\tan 160^\circ$

11. Explain/show why the following are true.

a. $\cos 23^\circ = \cos 743^\circ$

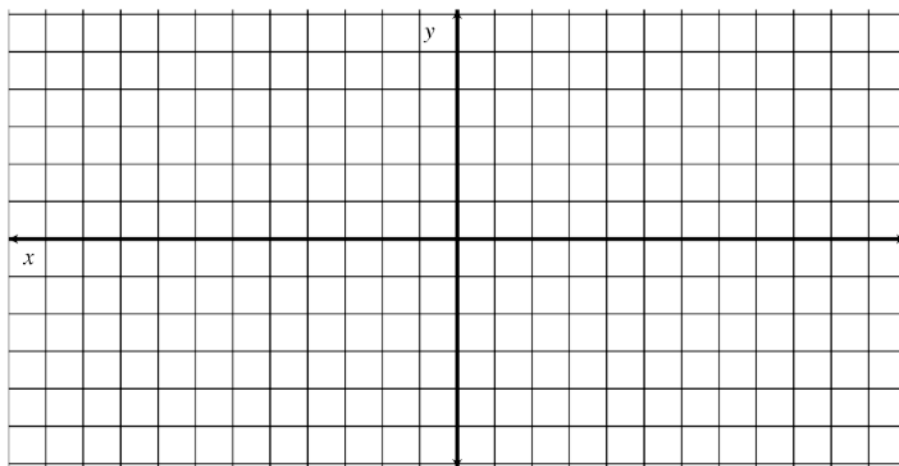
b. $\tan \frac{7\pi}{4} = -\tan \frac{\pi}{4}$

12. An A.P. Calculus student has memorized that $\tan \frac{\pi}{3}$ is equal to $\sqrt{3}$. Give him an explanation why this is so.

13. Find all real numbers x in the interval $10\pi \leq x < 12\pi$ that give $\cos x$ the value of $-\frac{\sqrt{3}}{2}$.

14. Sketch the graph of the function. Include two full periods and label your axes.

$$y = 2 \sec(x) + 1$$



Bonus: Find a plausible function for the given graph.

